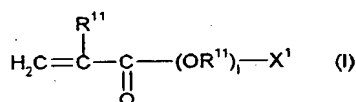


<p>2001-477717/52 A60 G02 L03 (A13 A14) FUJIF 1999.05.20  FUJI PHOTO FILM CO LTD *JP 2001031885-A  1999.05.20 1999-139928(+1999JP-139928) (2001.02.06) C09B 67/20,  G03F 7/004  <b>Pigment dispersants preventing aggregation of pigment particles effectively, pigment-dispersion compositions using the dispersants with excellent dispersibility and fluidity and color photosensitive compositions</b>  <b>C2001-143257</b>  Addnl. Data: 1999.12.22 1999JP-364066</p>	<p>A(8-E1, 12-W11H, 12-W12C) G(2-A3, 2-A4B) L(3-G2, 3-G5A)</p> <p>compositions are suitable for multicolored image formation on substrates for colorproofing and color fileters for liquid crystal color displays.</p> <p><b>ADVANTAGE</b></p> <p>The pigment dispersants can prevent aggregation of pigment particles effectively, have excellent dispersibility and fluidity and transmit lights excellently, the pigment-dispersion compositions have excellent dispersibility and fluidity, high staining powder and excellent alkali development suitability and the color photosensitive compositions have high staining power and excellent alkali development suitability.</p> <p><b>EXAMPLE</b></p> <p>Monomer solution consisting of 3-(N,N-dimethylamino)propylacrylamide (4.5 weight parts(pbw)), polymethyl methacrylate with a number average molecular weight of 6000 bearing methacryloyl in one terminal (19.5 pbw), methoxypolyethylene glycol methacrylate (6 pbw) and 1-methoxy-2-</p>
<p><b>NOVELTY</b></p> <p>A pigment dispersant contains a graft copolymer bearing both a microgen atom and an ether group.</p> <p><b>DETAILED DESCRIPTION</b></p> <p>INDEPENDENT CLAIMS are also included for pigment dispersion compositions using the dispersants and color photosensitive compositions using the pigment dispersion compositions.</p> <p><b>USE</b></p> <p>The pigment dispersion compositions are useful for coatings, printing inks and color indicator panels and the color photosensitive</p>	<p>JP 2001031885-A+</p>

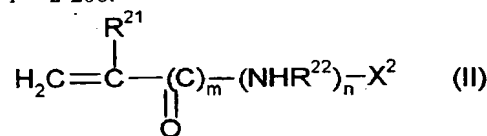
propyl acetate (45 pbw) and initiator solution consisting of 2,2-azobis(2,4-dimethylvaleronitrile) (0.04 pbw) and 1-methoxy-2-propyl acetate (9.6 pbw) were dropped into 1-methyl-2-propyl acetate (15 pbw) at 75°C under N<sub>2</sub> in 2 hours simultaneously and then mixed with 2,2-bis(2,4-dimethylvaleronitrile) (0.08 pbw) and the mixture was heated for 3 hours at 78°C and for 30 minutes at 90°C and cooled to room temperature to give graft copolymer solution having a nonvolatile component of 30wt% with the copolymer having a weight average molecular weight of 20,000 in polymerisation yield of 98%.

#### TECHNOLOGY FOCUS

Organic Chemistry - Preferred dispersants and materials: The pigment dispersant preferably contains (a) a polymerisable oligomer bearing an ethylenic unsaturated double bond in the terminal (15-98wt%), (b) a nitrogen-containing monomer bearing both a nitrogen atom and an ethylenic unsaturated double bond (1-40wt%) and (c) a polymerisable monomer bearing an ether group (1-70wt%) as copolymer units. (c) is typically of formula (I), (a) of at least one oligomer with a number average molecular weight of 100-20,000 bearing a (meth)acryloyl group in the terminal of alkyl (meth)acrylate homopolymers and copolymers, polystyrenes and copolymers of alkyl (meth)acrylate and polystyrene and (b) of formula (II).



R<sup>11</sup> = H or methyl;  
R<sup>12</sup> = 1-8C alkylene;  
X<sup>1</sup> = -OR<sup>13</sup> or -OCOR<sup>14</sup>;  
R<sup>13</sup> = H, 1-18C alkyl, phenyl or phenyl substituted by 1-18C alkyl;  
R<sup>14</sup> = 1-18C alkyl;  
l = 2-200.



R<sup>21</sup> = H or methyl;  
R<sup>22</sup> = 1-8C alkylene;  
X<sup>2</sup> = -N(R<sup>23</sup>)(R<sup>24</sup>), -R<sup>25</sup>N(R<sup>26</sup>)(R<sup>27</sup>), pyrrolidino, pyrrolidyl, pyridyl,

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piperidino, imidazolyl, carbazolyl, triazolyl, tetraazolyl or morpholino;

R<sup>23</sup>, R<sup>24</sup> = H, 1-6C alkyl or phenyl;

R<sup>25</sup> = 1-6C alkylene;

R<sup>26</sup>, R<sup>27</sup> = H, 1-6C alkyl or phenyl;

m, n = 0 or 1.

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**(54) [Title of the Invention]**

A pigment dispersant, a pigment-dispersed composition containing same, and a coloured photosensitive composition

**(57) [Abstract]**

[Problem] To provide a pigment dispersant which effectively prevents pigment aggregation and makes possible good dispersion of pigments.

[Resolution Means] A pigment dispersant which is characterized in that it contains graft copolymer possessing nitrogen atoms and ether groups. In a preferred form, the graft copolymer contains copolymer units based on a polymerizable oligomer which has a terminal ethylenically-unsaturated double bond, a nitrogen-containing monomer which has a nitrogen atom and an ethylenically-unsaturated double bond, and a polymerizable monomer which has an ether group.

**[Scope of Claims]**

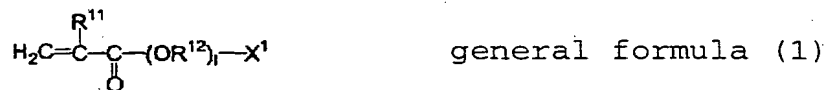
[Claim 1] A pigment dispersant which is characterized in that it contains graft copolymer possessing nitrogen atoms and ether groups.

[Claim 2] A pigment dispersant according to Claim 1 where the graft copolymer contains, as copolymer units, polymerizable oligomer which has a terminal ethylenically-unsaturated double bond, a nitrogen-containing monomer which has a nitrogen atom and an ethylenically-unsaturated double bond, and a polymerizable monomer which has an ether group.

[Claim 3] A pigment dispersant according to Claim 2 where the graft copolymer contains, as copolymer units, 15-98 wt% polymerizable oligomer, 1-40 wt% nitrogen-containing monomer and 1-70 wt% polymerizable monomer with an ether group.

[Claim 4] A pigment dispersant according to Claim 2 or Claim 3 where the polymerizable monomer with an ether group is of at least one type selected from the compounds represented by the following general formula (1):

[Chem. 1]



[where, in the formula,  $\text{R}^{11}$  represents a hydrogen atom or a methyl group and  $\text{R}^{12}$  represents a  $\text{C}_{1-8}$  alkylene group;  $\text{X}^1$  denotes  $-\text{OR}^{13}$  or  $-\text{OCOR}^{14}$ , where  $\text{R}^{13}$  represents a hydrogen atom, a  $\text{C}_{1-18}$  alkyl group, a phenyl group or a phenyl group substituted with a  $\text{C}_{1-18}$  alkyl group, and  $\text{R}^{14}$  represents a  $\text{C}_{1-18}$  alkyl group; and  $l$  represents 2-200].

[Claim 5] A pigment dispersant according to any of Claims 2 to 4 where the polymerizable oligomer is at least one type of oligomer selected from alkyl (meth)acrylate homopolymers and copolymers, polystyrene, and copolymers of alkyl (meth)acrylate and polystyrene {sic}<sup>i</sup>, of number average molecular weight lying in the range 1,000 to 20,000 and having a terminal (meth)acryloyl group.

[Claim 6] A pigment dispersant according to any of Claims 2 to 5 where the nitrogen-containing monomer is

of at least one type selected from the compounds represented by the following general formula (2):

[Chem. 2]



[where, in the formula,  $\text{R}^{21}$  represents a hydrogen atom or a methyl group;  $\text{R}^{22}$  represents a  $\text{C}_{1-8}$  alkylene group;  $\text{X}^2$  denotes  $-\text{N}(\text{R}^{23})(\text{R}^{24})$ ,  $-\text{R}^{25}\text{N}(\text{R}^{26})(\text{R}^{27})$ , a pyrrolidino group, pyrrolidyl group, pyridyl group, piperidino group, imidazolyl group, carbazolyl group, triazolyl group, tetrazolyl group or morpholino group, where  $\text{R}^{23}$  and  $\text{R}^{24}$  each represent a hydrogen atom, a  $\text{C}_{1-6}$  alkyl group or a phenyl group,  $\text{R}^{25}$  represents a  $\text{C}_{1-6}$  alkylene group, and  $\text{R}^{26}$  and  $\text{R}^{27}$  each represent a hydrogen atom, a  $\text{C}_{1-6}$  alkyl group or a phenyl group; and  $m$  and  $n$  each represent 1 or 0].

**[Claim 7]** A pigment-dispersed composition which is characterized in that it is formed by dispersing a pigment dispersant according to any of Claims 1 to 6, and pigment, in an organic solvent.

**[Claim 8]** A coloured photosensitive composition which is characterized in that it contains a pigment-dispersed composition according to Claim 7, binder polymer having acidic groups, polyfunctional monomer having two or more ethylenically-unsaturated double bonds and a photopolymerization initiator.

**[Detailed Description of the Invention]**

[0001]

[Technical Field of the Invention] The present invention relates to a pigment dispersant, to a pigment-dispersed composition containing same and to a coloured photosensitive composition. More particularly, it relates to a pigment dispersant which effectively prevents pigment aggregation and makes possible good dispersion of pigments; to a pigment-dispersed composition containing this pigment dispersant, which is outstanding in terms of its pigment dispersion properties and flow properties, and has outstanding colouring power, and which can be suitably employed in wide-ranging applications such as coating materials, printing inks and colour display panels; and to a coloured photosensitive composition containing said pigment-dispersed composition which can be suitably used for forming colour proofs and other such multi-coloured images on a substrate, or for producing the colour filters used in liquid crystal displays, etc.

[0002]

[Prior-Art] Pigments have been widely used in many fields due to their vivid colour tones and high colouring power. Generally speaking those pigments which are important in practical terms are mostly of fine particle size, and the vivid colour tones and high colouring power are obtained by finely-dividing the pigments and preventing aggregation. However, when a pigment is still more finely divided, the pigment dispersion often shows high viscosity. Hence, when such a pigment dispersion is prepared on an industrial scale, various problems arise like the removal of the pigment dispersion from the dispersing machine being difficult, distribution by pipeline no longer being possible and,

furthermore, gelling occurring during storage so that use becomes impossible.

[0003] Coloured photosensitive compositions containing an aforesaid pigment are valuable as materials for producing colour filters for use in liquid crystal displays or the like and, when a colour filter is produced using such a coloured photosensitive composition, there is widely used the pigment dispersion method which is outstanding in terms of product quality and production stability, etc. In this pigment dispersion method, a coating liquid of the coloured photosensitive composition is applied onto a transparent substrate to provide a coloured photosensitive layer and, following patterning by light exposure, development is performed to produce a first colour pixel pattern, and then this is repeated a number of times to form a plurality of pixel patterns on the transparent substrate.

[0004] However, since a pigment is employed here as the colouring material, if said pigment is insufficiently finely divided, light is scattered and absorbed by the pigment and the light transmittance is reduced. Moreover, there are problems such as rotation of the polarization axis by the light scattering and birefringence of the pigment, so that there is a lowering in the contrast of the liquid crystal display device (7<sup>th</sup> Colour-Optics Conference 1990, Colour Filter for a 512 Colour Display 10.4" size TFT-LCD, by Ueki, Koseki, Fukunaga and Yamanaka). Hence, it is necessary that the pigment be dispersed in a very finely divided state in the aforesaid coloured photosensitive composition.



[0005] The use of various types of dispersant (dispersing agent) is already known for obtaining a pigment dispersion or a coloured photosensitive composition which is outstanding in its flow and dispersion properties. Such dispersants can be broadly divided into polymer-based dispersants and low molecular weight compound dispersants, and examples of the polymer-based dispersants include polyacrylic acid salts, sodium maleate/olefin copolymer, polyester with terminal carboxy groups (JP-B-54-34009), polyester with acidic groups and/or basic groups employing tetrakis(2-hydroxyalkyl)ethylenediamine as a starting material (JP-A-2-245231), and copolymer comprising four components, namely macromonomer (oligomer with a terminal ethylenically-unsaturated group), monomer with a hydroxy group, monomer with a carboxy group and other monomer (JP-A-8-259876). Furthermore, known examples of the low molecular weight compound dispersants include sorbitan fatty acid esters, polyoxyethylene alkylamines, alkyldiamines and alkanolamine derivatives (US Patent 3536510).

[0006] Amongst such dispersants, in JP-A-7-140654, JP-A-5-273411 and JP-A-8-259876, there has been disclosed the fact that copolymer containing a macromonomer (an oligomer with a terminal ethylenically-unsaturated group) is valuable in a coloured photosensitive composition used as a material for producing a colour filter or colour proof, etc, and by using copolymer containing a macromonomer (oligomer with a terminal ethylenically-unsaturated group) there is obtained a pigment dispersion of small pigment particle size and outstanding dispersion stability. However, since said macromonomer does not contain nitrogen atoms, there is

the problem that it does not function as a dispersant when used alone and it needs to be jointly used with another dispersant. When said macromonomer is used as a dispersant, there is little of the thickening action seen with polymer dispersants and it is good in this respect, but there is the problem that its effect is insufficient in achieving fine division of the pigment and the dispersion properties are inadequate.

[0007] A coloured photosensitive composition containing pigment which shows a vivid colour tone and high colouring power is valuable as an image-forming material for the production of, for example, a colour filter or colour proof. When a coloured image is formed using said coloured photosensitive composition, generally speaking a coating liquid of the coloured photosensitive composition is applied onto a substrate to form a layer of the coloured photosensitive composition, after which exposure and development are carried out. The developer used as the time of the development is often an aqueous alkali solution, since this has little adverse effect on the environment, and so the layer based on the coloured photosensitive composition, more specifically the binding agent (binder) in this coloured photosensitive composition, needs to be soluble in said aqueous alkali solution. On the other hand, in terms of ease of drying after application, an organic solvent is effective as the solvent (the pigment dispersion medium) used in the coloured photosensitive composition application liquid. Hence, it is necessary that the binder employed in this coloured photosensitive composition has acidic groups and, furthermore, that it also has the property of dissolving in suitable organic solvents. In said coloured photosensitive composition the organic pigment

is dispersed in an aforesaid binder having this property and having acidic groups.

[0008] The layer based on such a coloured photosensitive composition generally needs to be extremely thin and, furthermore, it needs to show a high colour concentration in thin film form, so it is necessary for the organic pigment to be dispersed in a very finely-divided state in a binder having acidic groups which is soluble in organic solvent. However, no pigment dispersing material, pigment-dispersed composition containing same or coloured photosensitive composition, outstanding in terms of aforesaid pigment dispersion and flow properties, has yet been provided.

[0009]

[Problems to be Resolved by the Invention] The problems addressed by the present invention are to resolve the various difficulties of the prior-art described above and to realize the following objectives. Specifically, an objective of the present invention lies in providing a pigment dispersant which enables there to be achieved pigment stability without pigment aggregation, and gives excellent dispersion and flow properties, together with outstanding light transmission properties. A further objective of the present invention lies in providing a pigment-dispersed composition containing said dispersant, which is outstanding in term of its pigment dispersion and flow properties, has a high colouring power, excellent alkali-development suitability, and is suitable for use in wide-ranging applications such as coating materials, printing inks, colour display panels and the like. Still another objective of the present

invention lies in providing a coloured photosensitive composition which contains said pigment-dispersed composition, has high colouring power, is excellent in its alkali-development suitability, and can be advantageously used in the formation of colour proofs and other such multi-coloured images on a substrate or in the production of the colour filters used in liquid crystal displays, etc.

[0010]

[Means for Resolving the Problems] As a result of a painstaking investigation to resolve the aforesaid problems, the present inventors have made the following findings. Specifically, when an organic pigment is dispersed in a binder which has acidic groups and which is soluble in an organic solvent, there is a tendency for the viscosity to rise due to the action of the intermolecular forces between said acidic groups and the organic pigment. The dispersion stability is enhanced by this increase in viscosity but, as well as a lowering of the handling properties and usability, etc, there is also a tendency for fine dispersion of the organic pigment to be more difficult to achieve. Hence, a dispersant is desired which can promote dispersion without an accompanying rise in viscosity, and known examples of such dispersants are low molecular weight compound dispersants, in particular amine compounds. However, in the case of such amine compounds, a salt is formed with the acidic groups, and dissolution of the photosensitive resin layer in the developer is facilitated, etc, so there may be adverse effects during subsequent development. With alkaline dispersants or readily water-soluble dispersants there is the same

tendency as in the case of the amine compounds. On the other hand, the inventors have found that in the case of the aforesaid macromonomer, while the aforesaid problem of increase in viscosity is suppressed to a certain degree on account of the steric effects of the polymer chains, the pigment dispersion properties are inadequate.

[0011] The present invention is based on the aforesaid findings made by the inventors, and the means for resolving the aforesaid problems is as follows:-

<1> A pigment dispersant which is characterized in that it contains graft copolymer possessing nitrogen atoms and ether groups.

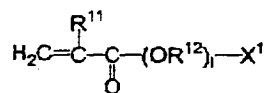
<2> A pigment dispersant according to <1> where the graft copolymer contains, as copolymer units, polymerizable oligomer which has a terminal ethylenically-unsaturated double bond, a nitrogen-containing monomer which has a nitrogen atom and an ethylenically-unsaturated double bond, and a polymerizable monomer which has an ether group.

<3> A pigment dispersant according to <2> where the graft copolymer contains, as copolymer units, 15-98 wt% polymerizable oligomer, 1-40 wt% nitrogen-containing monomer and 1-70 wt% polymerizable monomer with an ether group.

[0012] <4> A pigment dispersant according to <2> or <3> where the polymerizable monomer with an ether group is of at least one type selected from the compounds represented by the following general formula (1):

[0013]

[Chem. 3]



general formula (1)

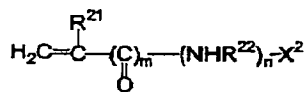
[0014] [where, in the formula,  $\text{R}^{11}$  represents a hydrogen atom or a methyl group and  $\text{R}^{12}$  represents a  $\text{C}_{1-8}$  alkylene group;  $\text{X}^1$  denotes  $-\text{OR}^{13}$  or  $-\text{OCOR}^{14}$ , where  $\text{R}^{13}$  represents a hydrogen atom, a  $\text{C}_{1-18}$  alkyl group, a phenyl group or a phenyl group substituted with a  $\text{C}_{1-18}$  alkyl group and  $\text{R}^{14}$  represents a  $\text{C}_{1-18}$  alkyl group; and  $l$  represents 2-200].

[0015] <5> A pigment dispersant according to any of <2> to <4> where the polymerizable oligomer is at least one type of oligomer selected from alkyl (meth)acrylate homopolymers and copolymers, polystyrene, and copolymers of alkyl (meth)acrylate and polystyrene {sic} of number average molecular weight lying in the range 1,000 to 20,000 and having a terminal (meth)acryloyl group.

<6> A pigment dispersant according to any of <2> to <5> where the nitrogen-containing monomer is of at least one type selected from the compounds represented by the following general formula (2):

[0016]

[Chem. 4]



general formula (2)

[0017] [where, in the formula,  $\text{R}^{21}$  represents a hydrogen atom or a methyl group;  $\text{R}^{22}$  represents a  $\text{C}_{1-8}$  alkylene group;  $\text{X}^2$  denotes  $-\text{N}(\text{R}^{23})(\text{R}^{24})$ ,  $-\text{R}^{25}\text{N}(\text{R}^{26})(\text{R}^{27})$ , a pyrrolidino group, pyrrolidyl group, pyridyl group,

piperidino group, imidazolyl group, carbazolyl group, triazolyl group, tetrazolyl group or morpholino group, where  $R^{23}$  and  $R^{24}$  each represent a hydrogen atom, a  $C_{1-6}$  alkyl group or a phenyl group,  $R^{25}$  represents a  $C_{1-6}$  alkylene group, and  $R^{26}$  and  $R^{27}$  each represent a hydrogen atom, a  $C_{1-6}$  alkyl group or a phenyl group; and m and n each represent 1 or 0].

[0018] <7> A pigment-dispersed composition which is characterized in that it is formed by dispersing a pigment dispersant according to any of <1> to <6>, and pigment, in an organic solvent.

<8> A coloured photosensitive composition which is characterized in that it contains a pigment-dispersed composition according to <7>, binder polymer with acidic groups, polyfunctional monomer having two or more ethylenically-unsaturated double bonds, and a photopolymerization initiator.

[0019]

[Mode of Practising the Invention] <<The Pigment Dispersant>> The pigment dispersant of the present invention contains a graft copolymer which has nitrogen atoms and ether groups, and optionally it contains other suitably selected components.

[0020] (Graft Copolymer) The aforesaid graft copolymer will at least contain nitrogen atoms and ether groups, and it may also contain other monomers as copolymer units. In this graft copolymer, the nitrogen atoms may be present in the main chain or in side chains.

[0021] The weight average molecular weight ( $M_w$ ) of the graft copolymer is preferably 3,000 to 100,000, with 5,000 to 50,000 being further preferred. If the aforesaid weight average molecular weight ( $M_w$ ) is less than 3,000, it is not possible to prevent pigment aggregation and the viscosity may rise. If it exceeds 100,000, the organic solvent solubility will be inadequate, and the viscosity may rise. Now, the weight average molecular weight is the weight average molecular weight measured by gel permeation chromatography (carrier: tetrahydrofuran), based on polystyrene conversion.

[0022] In an embodiment, <sup>ii</sup> this graft copolymer contains at least copolymer units based on a polymerizable oligomer having a terminal ethylenically-unsaturated double bond, a nitrogen-containing monomer which has a nitrogen atom and an ethylenically-unsaturated double bond, and a polymerizable monomer which has an ether group. It may optionally include copolymer units based on other monomers.

[0023] As shown in Figure 1, in this graft copolymer, side chains 2 based on the polymerizable oligomer are bonded by graft copolymerization to the main chain having at least nitrogen atoms 3 and side chains 5 with ether groups, and the connections 1 between the main chain and side chains are produced as a result of the polymerization of the terminal ethylenically-unsaturated double bond in this polymerizable oligomer. The main chain and/or side chains may also optionally include copolymer units based on other monomers.



[0024] The graft copolymer is formed by a polymerization reaction between the terminal ethylenically-unsaturated double bond in the aforesaid polymerizable oligomer, the ethylenically-unsaturated double bond in the aforesaid nitrogen-containing monomer and the aforesaid polymerizable monomer with an ether group.

[0025] With regard to the amounts of these copolymer units in the graft copolymer, that of the aforesaid polymerizable oligomer is 15-98 wt%, and preferably 25-90 wt%, that of the aforesaid nitrogen-containing monomer is 1-40 wt% and preferably 5-30 wt%, and that of the aforesaid polymerizable monomer containing an ether group is 1-70 wt% and preferably 5-60 wt%.

[0026] If the amount of aforesaid polymerizable oligomer is less than 15 wt%, then there is not obtained the steric repulsion effect as a pigment dispersant, and it is not possible to prevent pigment aggregation. If the amount exceeds 98 wt%, the proportion of the nitrogen-containing monomer is lowered and the adsorption capability in terms of the pigment is reduced, so that the dispersion properties may be inadequate. If the content of the aforesaid nitrogen-containing monomer is less than 1 wt%, the adsorption capability in terms of pigment is lowered, so the dispersion properties are inadequate, whereas if the amount exceeds 40 wt% the proportion of the aforesaid polymerizable oligomer is reduced, so a steric repulsion effect as a pigment dispersant is not obtained and there may be inadequate prevention of pigment aggregation. If the content of the aforesaid polymerizable monomer containing an ether group is less than 1 wt%, the development properties at

the time of the production of a colour filter or the like may be inadequate, whereas if it is more than 70 wt% the capability as a pigment dispersant may be reduced.

[0027] - Polymerizable Oligomer -

The aforesaid polymerizable oligomer (hereinafter sometimes referred to as the "macromonomer") is an oligomer having a group with an ethylenically-unsaturated double bond at a terminal. In the present invention, amongst such polymerizable oligomers, those having an aforesaid ethylenically-unsaturated double bond just at one of the two terminals is preferred.

[0028] The molecular weight of the aforesaid polymerizable oligomer is preferably a number average molecular weight ( $M_n$ ), based on polystyrene conversion, of 1,000 to 20,000, and more preferably 2,000 to 10,000. If this number average molecular weight is less than 1,000 then the steric repulsion effect as a pigment dispersant is insufficient, while if it exceeds 20,000 then time may be required for adsorption onto the pigment due to the steric effect.

[0029] The aforesaid oligomer is generally, for example, a homopolymer or copolymer formed from at least one type of monomer selected from alkyl (meth)acrylates, hydroxyalkyl (meth)acrylates, styrene, acrylonitrile, vinyl acetate and butadiene, amongst which the alkyl (meth)acrylate homopolymers or copolymers, and polystyrene, are preferred. In the present invention these oligomers may have substituent groups, and there

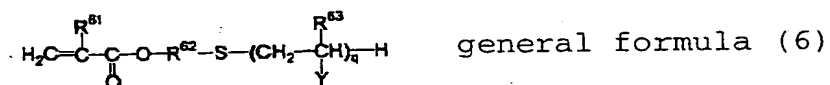
are no particular restrictions on the substituents but examples are halogen atoms.

[0030] As suitable examples of the aforesaid group with an ethylenically-unsaturated double bond, there are the (meth)acryloyl group, vinyl group and the like, amongst which the (meth)acryloyl group is preferred.

[0031] In the present invention, from amongst the aforesaid polymerizable oligomers, those represented by the following general formula (6) are preferred.

[0032]

[Chem. 5]



[0033] In general formula (6),  $\text{R}^{61}$  and  $\text{R}^{63}$  represent hydrogen atoms or methyl groups.  $\text{R}^{62}$  represents a  $\text{C}_{1-8}$  alkylene group optionally substituted with an alcoholic hydroxy group, but a  $\text{C}_{2-4}$  alkylene group is preferred. Y represents a phenyl group, a phenyl group with a  $\text{C}_{1-4}$  alkyl group, or  $-\text{COOR}^{64}$  (where  $\text{R}^{64}$  represents a  $\text{C}_{1-6}$  alkyl group optionally substituted with an alcoholic hydroxy group or a halogen, or a phenyl group or  $\text{C}_{7-10}$  arylalkyl group), preferably a phenyl group or  $-\text{COOR}^{64}$  (where, here,  $\text{R}^{64}$  represents a  $\text{C}_{1-4}$  alkyl group optionally substituted with an alcoholic hydroxy group). q represents 20-200.<sup>iii</sup>

[0034] Specific examples of the aforesaid polymerizable oligomer are poly-2-hydroxyethyl (meth)acrylate, polystyrene, polymethyl (meth)acrylate, poly-n-butyl (meth)acrylate, poly-iso-butyl (meth)acrylate and

copolymers of these, where the polymers have a (meth)acryloyl group bonded at one molecular terminal.

[0035] The aforesaid polymerizable oligomer may be a commercial product or a suitably synthesized material. Examples of commercial products are polystyrene oligomer with a methacryloyl group at one terminal ( $M_n = 6,000$ , commercial name: AS-6, produced by the Toagosei Chemical Industry Co.), polymethyl methacrylate oligomer with a methacryloyl group at one terminal ( $M_n = 6,000$ , commercial name: AA-6, produced by the Toagosei Chemical Industry Co.), poly-n-butyl acrylate oligomer with a methacryloyl group at one terminal ( $M_n = 6,000$ , commercial name: AB-6, produced by the Toagosei Chemical Industry Co.), polymethyl methacrylate/2-hydroxyethyl methacrylate oligomer with a methacryloyl group at one terminal ( $M_n = 7,000$ , commercial name: AA-714, produced by the Toagosei Chemical Industry Co.), polybutyl methacrylate/2-hydroxyethyl methacrylate oligomer with a methacryloyl group at one terminal ( $M_n = 7,000$ , commercial name: 707S, produced by the Toagosei Chemical Industry Co.), poly-2-ethylhexyl methacrylate/2-hydroxyethyl methacrylate oligomer with a methacryloyl group at one terminal ( $M_n = 7,000$ , commercial name: AY-707S or AY-714S produced by the Toagosei Chemical Industry Co.) and the like.

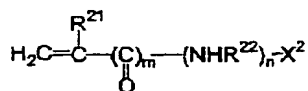
[0036] Specific examples of preferred aforesaid polymerizable oligomers in the present invention are one or more oligomers selected from alkyl (meth)acrylate polymers and alkyl (meth)acrylate/polystyrene copolymers, of number average molecular weight 1,000 to 20,000, with a (meth)acryloyl group at a terminal.

[0037] - Nitrogen-Containing Monomer -

The aforesaid nitrogen-containing monomer is suitably one or more compounds represented by the following general formula (2) for example.

[0038]

[Chem. 6]



general formula (2)

[0039] In aforesaid general formula (2),  $\text{R}^{21}$  represents a hydrogen atom or a methyl group.  $\text{R}^{22}$  represents a  $\text{C}_{1-8}$  alkylene group, with a  $\text{C}_{1-6}$  alkylene group being preferred and a  $\text{C}_{2-3}$  alkylene group being particularly preferred.

[0040]  $\text{X}^2$  represents  $-\text{N}(\text{R}^{23})(\text{R}^{24})$ ,  $-\text{R}^{25}\text{N}(\text{R}^{26})(\text{R}^{27})$ , a pyrrolidino group, pyrrolidyl group, pyridyl group, piperidino group, imidazolyl group, carbazolyl group, triazolyl group, tetrazolyl group or morpholino group, where  $\text{R}^{23}$  and  $\text{R}^{24}$  each represent a hydrogen atom, a  $\text{C}_{1-6}$  alkyl group or a phenyl group,  $\text{R}^{25}$  represents a  $\text{C}_{1-6}$  alkylene group, and  $\text{R}^{26}$  and  $\text{R}^{27}$  each represent a hydrogen atom, a  $\text{C}_{1-6}$  alkyl group or a phenyl group.

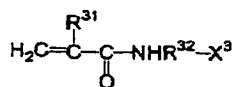
[0041] Amongst the above,  $-\text{N}(\text{R}^{23})(\text{R}^{24})$  or  $-\text{R}^{25}\text{N}(\text{R}^{26})(\text{R}^{27})$  {sic} is preferred; where  $\text{R}^{23}$  and  $\text{R}^{24}$  in  $-\text{N}(\text{R}^{23})(\text{R}^{24})$  are preferably each a hydrogen atom, a  $\text{C}_{1-4}$  alkyl group or a phenyl group,  $\text{R}^{25}$  in  $-\text{R}^{25}\text{N}(\text{R}^{26})(\text{R}^{27})$  is preferably a  $\text{C}_{2-6}$  alkylene group, and  $\text{R}^{26}$  and  $\text{R}^{27}$  are preferably each a  $\text{C}_{1-4}$  alkyl group. Furthermore, amongst the aforesaid pyridyl groups, the 4-pyridyl and 2-pyridyl groups are preferred, and amongst the aforesaid piperidino groups, 1-

piperidino is preferred. Amongst the aforesaid pyrrolidyl groups, the 2-pyrrolidyl group is preferred, and amongst the aforesaid morpholino groups, the 4-morpholino group is preferred. m and n represent 1 or 0 and it is preferred that m = 1 and n = 1, or that m = 1 and n = 0 (in other words, it is preferred that the compounds correspond to those represented by the following general formulae (3) or (4)).

[0042] In the present invention, amongst the compounds represented by aforesaid general formula (2), one or more compounds selected from those compounds represented by the following general formulae (3) to (5) are preferred.

[0043]

[Chem. 7]

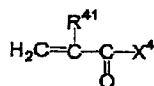


general formula (3)

[0044] In general formula (3), R<sup>31</sup> has the same meaning as R<sup>21</sup>, and R<sup>32</sup> has the same meaning as R<sup>22</sup>. X<sup>3</sup> has the same meaning as X<sup>2</sup>.

[0045]

[Chem. 8]



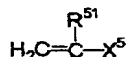
general formula (4)

[0046] In general formula (4), R<sup>41</sup> has the same meaning as R<sup>21</sup>, and X<sup>4</sup> has the same meaning as X<sup>2</sup>, but either -N(R<sup>43</sup>)(R<sup>44</sup>) (where R<sup>43</sup> and R<sup>44</sup> have the same meanings as R<sup>23</sup> and R<sup>24</sup>) or -R<sup>45</sup>-N(R<sup>46</sup>)(R<sup>47</sup>) (where R<sup>45</sup>, R<sup>46</sup> and R<sup>47</sup> have

the same meanings as  $R^{25}$ ,  $R^{26}$  and  $R^{27}$  respectively) is preferred.

[0047]

[Chem. 9]



general formula (5)

[0048] In general formula (5),  $R^{51}$  has the same meaning as  $R^{21}$ .  $X^5$  represents a pyrrolidino group, pyrrolidyl group, pyridyl group, piperidino group, imidazolyl group, carbazolyl, triazolyl group, tetrazolyl group or morpholino group.

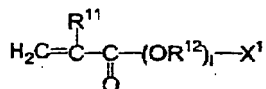
[0049] Specific examples of the compounds represented by aforesaid general formula (2) are dimethyl (meth)acrylamide, diethyl (meth)acrylamide, diisopropyl (meth)acrylamide, di-n-butyl (meth)acrylamide, diisobutyl (meth)acrylamide, morpholino (meth)acrylamide, piperidino (meth)acrylamide, N-methyl-2-pyrrolidyl (meth)acrylamide and N,N-methylphenyl (meth)acrylamide (these are referred to as (meth)acrylamides);

[0050] 2-(N,N-dimethylamino)ethyl (meth)acrylamide, 2-(N,N-diethylamino)ethyl (meth)acrylamide, 3-(N,N-diethylamino)propyl (meth)acrylamide, 3-(N,N-dimethylamino)propyl (meth)acrylamide, 1-(N,N-dimethylamino)-1,1-dimethylmethyl (meth)acrylamide and 6-(N,N-diethylamino)hexyl (meth)acrylamide (these are referred to as aminoalkyl (meth)acrylamides); and vinyl pyridine, N-vinylimidazole, N-vinylcarbazole, N-vinyltriazole and vinyltetrazole.

[0051] - Polymerizable Monomer with an Ether Group -  
The aforesaid polymerizable monomer with an ether group is suitably one or more compounds selected from those represented by the following formula (1).

[0052]

[Chem.10]



general formula (1)

[0053] In the formula,  $\text{R}^{11}$  represents a hydrogen atom or a methyl group;  $\text{R}^{12}$  represents a  $\text{C}_{1-8}$  alkylene group, preferably a  $\text{C}_{1-6}$  alkylene group, and more preferably a  $\text{C}_{2-3}$  alkylene group;  $\text{X}^1$  denotes  $-\text{OR}^{13}$  or  $-\text{OCOR}^{14}$ , where  $\text{R}^{13}$  represents a hydrogen atom, a  $\text{C}_{1-18}$  alkyl group, a phenyl group or a phenyl group substituted with a  $\text{C}_{1-18}$  alkyl group, and  $\text{R}^{14}$  represents a  $\text{C}_{1-18}$  alkyl group; and  $l$  represents 2-200, preferably 5-100 and in particular 10-100.].

[0054] The polymerizable monomer with an ether group is not particularly restricted providing it has an ether group and is polymerizable. It can be suitably selected from known compounds such as polyethylene glycol mono(meth)acrylate, polypropylene glycol mono(meth)acrylate, polyethylene glycol polypropylene glycol mono(meth)acrylate, polytetramethylene glycol monomethacrylate and the like. These may be commercial products or they may be suitably synthesized compounds. Examples of the commercial products are methoxy-polyethylene glycol methacrylate (commercial name NK Ester M-40G, M-90G, M-230G (all produced by the Toagosei Chemical Industry Co.), or commercial name Blenmer PME-100, PME-200, PME-400, PME-1000, PME-2000 and PME-4000



(all produced by the Nippon Oil & Fats Co.)), polyethylene glycol monomethacrylate (commercial name Blenmer PE-90, PE-200, PE-350, produced by the Nippon Oil & Fats Co.), polypropylene glycol monomethacrylate (commercial name Blenmer PP-500, PP-800, PP-1000, produced by the Nippon Oil & Fats Co.), polyethylene glycol polypropylene glycol monomethacrylate (commercial name Blenmer 70PEP-370B, produced by the Nippon Oil & Fats Co.), polyethylene glycol polytetramethylene glycol monomethacrylate (commercial name Blenmer 55PET-800, produced by the Nippon Oil & Fats Co.), and polypropylene glycol polytetramethylene glycol monomethacrylate (commercial name Blenmer NHK-5050, produced by the Nippon Oil & Fats Co.).

[0055] - Other Monomer -

The aforesaid graft copolymer may also contain further copolymer units based on other monomer. This other monomer is not particularly restricted and may be suitably selected according to the objectives. Examples include aromatic vinyl compounds (such as styrene,  $\alpha$ -methylstyrene and vinyltoluene), alkyl (meth)acrylate esters (such as methyl (meth)acrylate, ethyl (meth)acrylate, n-butyl (meth)acrylate and isobutyl (meth)acrylate, alkylaryl (meth)acrylates (such as benzyl (meth)acrylate), glycidyl (meth)acrylate, vinyl carboxylic acid esters (such as vinyl acetate and vinyl propionate), vinyl cyanides (such as (meth)acrylonitrile and  $\alpha$ -chloroacrylonitrile), aliphatic conjugated dienes (such as 1,3-butadiene and isoprene), (meth)acrylic acid and the like. Of these, the unsaturated carboxylic acids, the alkyl (meth)acrylates, the alkylaryl

(meth)acrylates and the vinyl carboxylic acid esters are preferred.

[0056] The content of this other monomer in the aforesaid graft copolymer is preferably, for example, 5 to 70 wt%. If the amount thereof is less than 5 wt%, it may not be possible to control some properties of the coated film, while if it exceeds 70 wt% then performance as a pigment dispersant may not be fully manifested.

[0057] Preferred specific examples of the aforesaid graft copolymer are (1) copolymer of N-vinylimidazole/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (2) copolymer of N-vinylcarbazole/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (3) copolymer of N-vinyltriazole/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (4) copolymer of N-vinylimidazole/polyethylene glycol mono(meth)acrylate/polystyrene with a terminal methacryloyl group, (5) copolymer of N-vinylcarbazole/polyethylene glycol mono(meth)acrylate/polystyrene with a terminal methacryloyl group, (6) copolymer of N-vinylimidazole/polyethylene glycol mono(meth)acrylate/methyl (meth)acrylate/polystyrene with a terminal methacryloyl group, (7) copolymer of N-vinylimidazole/polyethylene glycol mono(meth)acrylate/benzyl (meth)acrylate/polystyrene with a terminal methacryloyl group,

[0058] (8) copolymer of vinyl pyridine/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (9) copolymer of N,N-

dimethyl-2-piperidylethyl acrylate/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (10) copolymer of 4-morpholinoethyl acrylate/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (11) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (12) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/polystyrene with a terminal methacryloyl group,

[0059] (13) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/methyl (meth)acrylate/polystyrene with a terminal methacryloyl group, (14) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/copolymer of methyl (meth)acrylate and 2-hydroxyethyl methacrylate with a terminal methacryloyl group, (15) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/copolymer of methyl (meth)acrylate and 2-hydroxyethyl methacrylate with a terminal methacryloyl group, (16) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polyethylene glycol mono(meth)acrylate/copolymer of methyl (meth)acrylate and 2-hydroxyethyl methacrylate with a terminal methacryloyl group,

[0060] (17) copolymer of 3-(N,N-dimethylamino)propylacrylamide/polypropylene glycol mono(meth)acrylate/polymethyl (meth)acrylate with a terminal methacryloyl group, (18) copolymer of 3-(N,N-

dimethylamino)propylacrylamide/polyethylene glycol  
polypropylene glycol mono(meth)acrylate/polymethyl  
(meth)acrylate with a terminal methacryloyl group, (19)  
copolymer of 3-(N,N-  
dimethylamino)propylacrylamide/polyethylene glycol  
polytetramethylene glycol mono(meth)acrylate/polymethyl  
(meth)acrylate with a terminal methacryloyl group, and  
(20) copolymer of 3-(N,N-  
dimethylamino)propylacrylamide/polypropylene glycol  
polytetramethylene glycol mono(meth)acrylate/polymethyl  
(meth)acrylate with a terminal methacryloyl group, or  
the like.

[0061] The aforesaid graft copolymers can be obtained by, for example, the radical polymerization in a solvent of the components for forming the respective copolymer units. At the time of said radical polymerization, there can be used radical polymerization initiator and, furthermore, there can also be employed a chain transfer agent (for example, 2-mercaptoethanol or dodecyl mercaptan). Below, a number of examples of the synthesis of the aforesaid graft copolymer are provided.

[0062] [Synthesis Example 1] 15 parts by weight of 1-methoxy-2-propyl acetate was introduced into a three-necked flask which had been purged with nitrogen. Heating was carried out while stirring with a three-one motor and passing a current of nitrogen through the flask, and the temperature inside the flask was raised to 78°C. The following separately-prepared monomer solution and initiator solution were then respectively added dropwise simultaneously over two hours.

(Monomer Solution)

3-(N,N-dimethylamino)propylacrylamide	4.5 parts by weight
polymethyl methacrylate with a methacryloyl group at one terminal (number average molecular weight: 6000; commercial name: Macromonomer AA-6, produced by the Toagosei Chemical Industry Co.)	19.5 parts by weight
methoxy polyethylene glycol methacrylate (commercial name: NK Ester M-230G, produced by the Toagosei Chemical Industry Co.)	6 parts by weight
1-methoxy-2-propyl acetate	45 parts by weight

(Initiator Solution)

2,2-azobis(2,4-dimethylvaleronitrile) (commercial name: V-65, produced by Wako Pure Chemical Industries Ltd)	0.04 part by weight
1-methoxy-2-propyl acetate	9.6 parts by weight

[0063] Following the dropwise addition, 0.08 part by weight of 2,2-azobis(2,4-dimethylvaleronitrile) (commercial name: V-65) was added to the solution inside the flask and the flask contents maintained for a further 3 hours at 78°C, after which heating was performed and the contents maintained for 30 minutes at 90°C. Next, the solution inside the flask was cooled to room temperature and a solution of graft copolymer obtained. The solids component content of the graft copolymer solution was 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000. Here, the weight average molecular weight was measured by gel permeation chromatography (C-R4A, produced by the Shimadzu Corporation).

[0064] [Synthesis Example 2] The same procedure was followed as in Synthesis Example 1 except that the methoxy polyethylene glycol methacrylate (commercial

name: NK Ester M-230G, produced by the Toagosei Chemical Industry Co.) in aforesaid Synthesis Example 1 was replaced by methoxy polyethylene glycol methacrylate (commercial name: Blenmer PME-4000, produced by the Nippon Oil & Fats Co.). The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000.

[0065] [Synthesis Example 3] The same procedure was followed as in Synthesis Example 1 except that the methoxy polyethylene glycol methacrylate (commercial name: NK Ester M-230G, produced by the Toagosei Chemical Industry Co.) in aforesaid Synthesis Example 1 was replaced by methoxy polyethylene glycol methacrylate (commercial name: Blenmer PME-2000, produced by the Nippon Oil & Fats Co.). The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000.

[0066] [Synthesis Example 4] The same procedure was followed as in Synthesis Example 1 except that the methoxy polyethylene glycol methacrylate (commercial name: NK Ester M-230G, produced by the Toagosei Chemical Industry Co.) in aforesaid Synthesis Example 1 was replaced by polypropylene glycol monomethacrylate (commercial name: Blenmer PP-1000, produced by the Nippon Oil & Fats Co.). The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average

molecular weight of the graft copolymer obtained was 20,000.

[0067] [Synthesis Example 5] The same procedure was followed as in Synthesis Example 1 employing 4.5 parts by weight of the 3-(N,N-dimethylamino)propylacrylamide, 22.5 parts by weight of polymethyl methacrylate with a methacryloyl group at one terminal (number average molecular weight: 6000; Macromonomer AA-6, produced by the Toagosei Chemical Industry Co.) and 3 parts by weight of methoxy polyethylene glycol methacrylate (commercial name: NK Ester M-230G, produced by the Toagosei Chemical Industry Co.) The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000.

[0068] [Synthesis Example 6] The same procedure was followed as in Synthesis Example 1 except that the 3-(N,N-dimethylamino)propylacrylamide in said Synthesis Example 1 was replaced by N-vinylimidazole. The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000.

[0069] [Synthesis Example 7] The same procedure was followed as in Synthesis Example 1 except that the polymethyl methacrylate with a methacryloyl group at one terminal was replaced by methyl methacrylate/2-hydroxyethyl methacrylate copolymer having a methacryloyl group at one terminal (number average molecular weight: 7,000, Macromonomer AA-714, produced

by the Toagosei Chemical Industry Co.). The graft copolymer solution obtained had a solids component content of 30 wt% and the polymerization yield was 98%. The weight average molecular weight of the graft copolymer obtained was 20,000.

[0070] The pigment dispersant of the present invention may include only the aforesaid graft copolymer or, where required, it may also contain suitably-selected other components. As examples of these other components, there are known dispersants, specifically amide compounds such as nonanoamide, decanoamide, dodecanoamide, N-dodecylhexadecanoamide, N-octadecylpropionamide, N,N-dimethyldodecanoamide and N,N-dihexylacetamide, amine compounds such as diethylamine, diheptylamine, dibutylhexadecylamine, N,N,N',N'-tetramethylmethanediamine, triethylamine, tributylamine and trioctylamine, amines with a hydroxy group such as monoethanolamine, diethanolamine, triethanolamine, N,N,N',N'-(tetrahydroxyethyl)-1,2-diaminoethane, N,N,N'-tri(hydroxyethyl)-1,2-diaminoethane, N,N,N',N'-tetra(hydroxyethylpolyoxyethylene)-1,2-diaminoethane, 1,4-bis(2-hydroxyethyl)piperazine and 1-(2-hydroxyethyl)piperazine, and also compounds such as (ni)pecotamide, isonipecotamide and nicotinamide. These may be commercially-available products or suitably synthesized materials. As an examples of a commercial product, there is Shigenox-105 (commercial name, produced by Hakkol Chemical).

[0071] The content of the aforesaid other components in the pigment dispersant is preferably 1-90 wt% and more preferably 1-70 wt%. If the aforesaid content is less

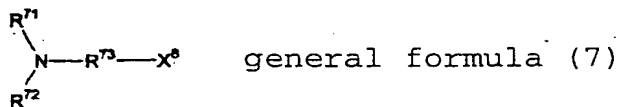


than 1 wt%, then sometimes it may not be possible to suppress the rise in the viscosity of the pigment-dispersed composition, while if it exceeds 90 wt% then sufficient performance as a pigment dispersant may not be shown.

[0072] The pigment dispersant of the present invention may also further contain amine compounds represented by the following general formula (7) or (8).

[0073]

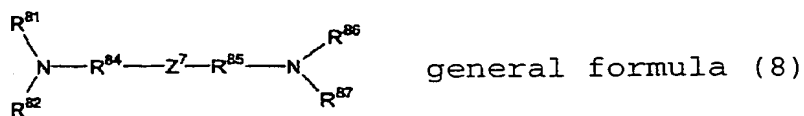
[Chem.11]



[0074] In general formula (7),  $\text{R}^{71}$  and  $\text{R}^{72}$  represent hydrogen atoms or optionally-substituted alkyl groups or aralkyl groups, and these may also be linked together to form a 5- or 6-membered saturated ring containing the nitrogen atom. This saturated ring may further contain 1-3 atoms selected from the oxygen atom, sulphur atom and nitrogen atom.  $\text{R}^{73}$  represents an alkylene group or alkylene group containing an ether linkage.  $\text{X}^6$  represents  $-\text{CON}(\text{Y}^{61})(\text{Y}^{62})$ ,  $-\text{OCON}(\text{Y}^{61})(\text{Y}^{62})$ ,  $-\text{N}(\text{Y}^{63})\text{CO}(\text{Y}^{64})$  or  $-\text{N}(\text{Y}^{63})\text{CON}(\text{Y}^{61})(\text{Y}^{62})$ .  $\text{Y}^{61}$ ,  $\text{Y}^{62}$ ,  $\text{Y}^{63}$  and  $\text{Y}^{64}$  each represent a hydrogen atom or an optionally-substituted alkyl group, aralkyl group or aryl group.

[0075]

[Chem.12]



[0076] In general formula (8),  $R^{81}$ ,  $R^{82}$ ,  $R^{86}$  and  $R^{87}$  each represent a hydrogen atom or an optionally-substituted alkyl group or aralkyl group, and these may also be mutually connected to form a 5- or 6-membered saturated ring containing the nitrogen atom. The saturated ring may also further contain 1 to 3 atoms selected from the oxygen atom, sulphur atom and nitrogen atom.  $R^{84}$  and  $R^{85}$  each represent an alkylene group or an alkylene group which contains an ether linkage.  $Z^7$  represents  $-\text{CON}(Y^{71})-$ ,  $-\text{CON}(Y^{71})-$  or  $-\text{N}(Y^{72})\text{CON}(Y^{73})-$ .  $Y^{71}$ ,  $Y^{72}$  and  $Y^{73}$  in turn have the same meanings as  $Y^{61}$ ,  $Y^{62}$  and  $Y^{63}$  in general formula (7) above.

[0077] As a specific example of an amine compound represented by aforesaid general formulae (7) or (8), there may be favourably employed bis(2-(1-morpholino)ethyl)terephthalamide.

[0078] Furthermore, the pigment dispersant of the present invention may also contain various types of surfactant, and including a surfactant is effective in raising the dispersion stability. Examples of the surfactants are anionic surfactants typified by alkylnaphthalenesulphonates and phosphate ester salts, cationic surfactants typified by amine salts, and amphoteric surfactants typified by amino carboxylic acids and those of the betaine type.

[0079] - Dispersion- Next, with reference to the drawings, explanation is provided of the dispersion of pigments based on the pigment dispersant of the present invention. Figure 2 is a schematic explanatory diagram showing the state when pigment dispersant containing

aforesaid graft copolymer is adsorbed onto the surface of a pigment particle.

[0080] When the pigment dispersant of the present invention is used, the pigment dispersant is adsorbed onto the surface of pigment particle 4 as shown in Figure 2. In such circumstances, the nitrogen atoms 3 present in the main chain of the graft copolymer in this pigment dispersant are adsorbed at the surface of pigment particle 4. Pigment particle 4 thus has a state covered by the main chains of the graft copolymer. Side chains 2 branch off from these main chains, and said side chains 2 extend outwards from the surface of pigment particle 4, and are present like a cloud covering the periphery of pigment particle 4. Since graft copolymer is adsorbed onto the surface of each individual pigment particle 4, the particles do not aggregate by mutual absorption but remain in a finely-divided state, so there is uniform dispersion by means of this graft copolymer and a readily flowable state is formed. Furthermore, side chains 5 which have ether groups branch off from the main chains of the graft copolymer and, in the same way as aforesaid side chains 2, extend outwards from the surface of the pigment particle 4. Due to the presence of these side chains 5 which contain ether groups, it is possible to achieve sufficient suitable alkali-development based on an aqueous alkali solution.

[0081] In cases where there is used an ordinary pigment dispersant in a coloured photosensitive composition, often a salt is formed between the acidic groups of the binder polymer with acidic groups contained in this coloured photosensitive composition and the nitrogen

atoms in the pigment dispersant, and there is binding due to strong intermolecular forces, but in the case of the pigment dispersant of the present invention such behaviour is suppressed due to the presence of the side chains 2 in the aforesaid graft copolymer, while the stability after dispersion is enhanced and the effects in terms of the dispersion enhancement due to the nitrogen atoms are also increased. Again, by means of this graft copolymer, at the time of the dispersion of organic pigment there is no accompanying increase in viscosity and the organic pigment dispersion properties are good, in particular the dispersion properties in terms of acidic organic pigments are excellent.

[0082] Dispersion based on the pigment dispersant of the present invention refers to the fact that the pigment particles which are generally present in a secondary particle state are divided into their primary particle state, and re-aggregation is prevented. The pigment dispersant of the present invention is a graft-type dispersant having sites for adsorption to the pigment and steric repulsion sites which prevent re-aggregation after said pigment has been dispersed in the primary particle state, and so even when used on its own it shows a sufficiently outstanding dispersion effect. The dispersion of pigment based on the pigment dispersant of the present invention is effectively achieved by directly mixing the pigment and said pigment dispersant, and it is preferred that this be carried out in a state such that, as far as possible, dispersible particles other than pigment are not present. When the dispersion of pigment is carried out in such a state, the pigment dispersant of the present invention is rapidly adsorbed around the pigment particles and said

pigment particles are readily dispersed, so that they readily flow and aggregation between pigment particles is effectively suppressed. On the other hand, if the pigment dispersion is carried out in a state with dispersible particles other than the pigment particles also present, the pigment dispersant of the present invention may not be adsorbed at the surface of the target pigment particles but be adsorbed at the surface of the other particles, so that the pigment dispersion effect of the pigment dispersant of the present invention is impaired. Consequently, in the case of, for example, the production of a photosensitive material or the like, in order for the pigment to be incorporated into said photosensitive material in an excellent dispersed state, it is preferred that the pigment and the pigment dispersant of the present invention first be mixed together at an early stage. It is undesirable that the pigment dispersant of the present invention be added and mixed-in at a later stage, such as at the time of the preparation of the coating liquid used for the photosensitive layer, etc..

[0083] The pigment dispersant of the present invention can be used favourably for the dispersion of known pigments, and it is especially favourably employed in the pigment-dispersed composition and the coloured photosensitive composition of the present invention discussed below.

[0084] <<Pigment-Dispersed Composition>> The pigment-dispersed composition of the present invention is formed by dispersing together the aforesaid pigment dispersant of the present invention and pigment, in an organic solvent.

[0085] - Pigment -

Organic pigments may be employed as the pigment. Examples of such organic pigments are yellow pigments, orange pigments, red pigments, violet pigments, blue pigments, green pigments, brown pigment, black pigments and the like.

[0086] Examples of the yellow pigments are C.I. Pigment Yellow 20, C.I. Pigment Yellow 24, C.I. Pigment Yellow 12, C.I. Pigment Yellow 17, C.I. Pigment Yellow 83, C.I. Pigment Yellow 86, C.I. Pigment Yellow 93, C.I. Pigment Yellow 109, C.I. Pigment Yellow 110, C.I. Pigment Yellow 117, C.I. Pigment Yellow 125, C.I. Pigment Yellow 137, C.I. Pigment Yellow 138, C.I. Pigment Yellow 139, C.I. Pigment Yellow 185, C.I. Pigment Yellow 147, C.I. Pigment Yellow 148, C.I. Pigment Yellow 153, C.I. Pigment Yellow, C.I. Pigment Yellow 154, C.I. Pigment Yellow 166, C.I. Pigment Yellow 168 and C.I. Pigment Yellow 185.

[0087] Examples of the orange pigments are C.I. Pigment Orange 36, C.I. Pigment Orange 43, C.I. Pigment Orange 51, C.I. Pigment Orange 55, C.I. Pigment Orange 59, C.I. Pigment Orange 61 and C.I. Pigment Orange 71,

[0088] Examples of the red pigments are C.I. Pigment Red 9, C.I. Pigment Red 97, C.I. Pigment Red 122, C.I. Pigment Red 123, C.I. Pigment Red 149, C.I. Pigment Red 168, C.I. Pigment Red 177, C.I. Pigment Red 180, C.I. Pigment Red 192, C.I. Pigment Red 215, C.I. Pigment Red 216, C.I. Pigment Red 217, C.I. Pigment Red 220, C.I. Pigment Red 223, C.I. Pigment Red 224, C.I. Pigment Red

226, C.I. Pigment Red 227, C.I. Pigment Red 228, C.I. Pigment Red 240, C.I. Pigment Red 48:1, C.I. Pigment Red 209, C.I. Pigment Red 146, C.I. Pigment Red 11, C.I. Pigment Red 81, C.I. Pigment Red 123, C.I. Pigment Red 213, C.I. Pigment Red 272, C.I. Pigment Red 270, C.I. Pigment Red 255, C.I. Pigment Red 264 and C.I. Pigment Red 254.

[0089] Examples of the violet pigments are C.I. Pigment Violet 19, C.I. Pigment Violet 23, C.I. Pigment Violet 29, C.I. Pigment Violet 30, C.I. Pigment Violet 37, C.I. Pigment Violet 40 and C.I. Pigment Violet 50.

[0090] Examples of the blue pigments are C.I. Pigment Blue 15, C.I. Pigment Blue 15:6, C.I. Pigment Blue 22, C.I. Pigment Blue 60 and C.I. Pigment Blue 64.

[0091] Examples of the green pigments are C.I. Pigment Green 7 and C.I. Pigment Green 36. Examples of the brown pigments are C.I. Pigment Brown 23, C.I. Pigment Brown 25 and C.I. Pigment Brown 26. An example of the black pigment is C.I. Pigment Black 7.

[0092] One of these pigments may be used on its own or there may be used two or more in combination. Amongst these examples, in the present invention pigments with acidic groups such as Pigment Yellow 138, Pigment Yellow 139, Pigment Yellow 185 and Pigment Yellow 83 are preferred, and Pigment Yellow 138, Pigment Yellow 139, Pigment Yellow 185, Pigment Red 254, Pigment Green 36 and Pigment Blue 15 are particularly preferred.

[0093] - Organic Solvent -

The aforesaid organic solvent is not especially restricted, and it may be suitably selected from amongst known solvents. Examples are (poly)alkylene glycol monoalkyl ethers such as ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, propylene glycol monomethyl ether, propylene glycol monoethyl ether, diethylene glycol monomethyl ether and ethylene glycol monoethyl ether, and the acetic acid esters thereof; acetic acid esters such as ethyl acetate, n-propyl acetate, isopropyl acetate, n-butyl acetate and isobutyl acetate; aromatic hydrocarbons such as benzene, toluene and xylene; ketones such as methyl ethyl ketone, acetone, methyl isobutyl ketone and cyclohexanone; and alcohols such as ethanol, propanol, butanol, hexanol, cyclohexanol, ethylene glycol, diethylene glycol and glycerol. One of these may be used on its own or two or more types may be employed together. Amongst these, the alkylene glycol monoalkyl ethers and the acetic acid esters thereof, the acetate esters and methyl ethyl ketone are preferred.

[0094] The amount of pigment in the aforesaid pigment-dispersed composition is normally 5-80 wt% and preferably 10-70 wt%. If the content is less than 5 wt%, the colouring power is insufficient, while if it exceeds 80 wt% the viscosity of the pigment-dispersed composition may rise.

[0095] The amount of pigment dispersant in the aforesaid pigment-dispersed composition is normally 0.1 to 200 parts by weight, and preferably 1 to 50 parts by weight, per 100 parts by weight of the pigment. If the amount is less than 0.1 part by weight, there may be a rise in the viscosity of the pigment-dispersed



composition, while if there is more than 200 parts by weight then, at the time of the colour filter preparation, it may be difficult to prepare the thickness of applied film for obtaining the desired chromaticity.

[0096] The content of the aforesaid organic solvent in the pigment-dispersed composition is normally 10 to 1,000 parts by weight, and preferably 20 to 500 parts by weight, per 100 parts by weight of the pigment. If the amount thereof is less than 10 parts by weight, the viscosity of the pigment-dispersed composition may rise, while if it exceeds 1,000 parts by weight securing the required space at the time of storage becomes difficult.

[0097] The pigment-dispersed composition of the present invention can be prepared for example in the following manner.

- 1) The method of adding and dispersing, in an aforesaid organic solvent (or vehicle); the composition obtained by prior-mixing of the aforesaid pigment and aforesaid pigment dispersant.
- 2) The method of separately adding and dispersing the aforesaid pigment and aforesaid pigment dispersant in the aforesaid organic solvent (or vehicle).
- 3) The method of separately dispersing the aforesaid pigment and aforesaid pigment dispersant beforehand in organic solvent (or vehicle), after which the dispersions obtained are mixed together.

4) The method of dispersing the aforesaid pigment in the aforesaid organic solvent (or vehicle), after which the dispersant is added to the dispersion thus obtained.

[0098] Here, vehicle refers to the medium in which the pigment is dispersed when the coating material has a liquid state, and it includes a component (the binder) in liquid form which will bind the pigment and solidify the applied film, and a component (aforesaid organic solvent) which dissolves and dilutes this.

[0099] The disperser (dispersion machine) used when dispersing the aforesaid pigment is not especially restricted, and examples include a kneader, roll mill, attriter, super-mill, dissolver, homomixer, sand mill and the like.

[0100] The formation of a coloured image using this pigment-dispersed composition can be carried out for example by applying a coating liquid containing this pigment-dispersed composition onto a substrate, and then drying to form a layer of the pigment-dispersed composition, or a layer of the pigment-dispersed composition formed on a temporary support is transferred to the substrate, and then on this is formed a layer of a known positive-type or negative-type photosensitive resin composition, after which exposure and developing are performed so that, along with the unexposed photosensitive resin composition layer, the layer of pigment-dispersed composition is eliminated in the same region.

[0101] <<Coloured Photosensitive Composition>> The coloured photosensitive composition at least contains

aforesaid pigment-dispersed composition and a photosensitive composition.

[0102] - Photosensitive Composition -

Examples of the photosensitive composition are the photosensitive compositions described in JP-A-3-282404. Specifically, they include photosensitive compositions comprising a negative-type diazo resin and a binder, photopolymerizable compositions, photosensitive compositions comprising azide compound and binder, and cinnamic acid type photosensitive compositions. Such photosensitive compositions may be of the type which can be developed with an aqueous alkali solution or of the type which can be developed by organic solvent, but in terms of preventing pollution, and from occupational hygiene considerations, the type which can be developed by means of an aqueous alkali solution is preferred.

[0103] - Photopolymerizable Composition -

Amongst the aforesaid photosensitive compositions, the photopolymerizable compositions are particularly preferred in the present invention. Said photopolymerizable compositions will contain at least a binder polymer with acidic groups, polyfunctional monomer with at least two ethylenically-unsaturated double bonds and photopolymerization initiator.

[0104] - Binder Polymer with Acidic Groups -

The binder polymer with acidic groups can confer both pigment dispersion stability and alkali development properties. Examples are copolymer of (meth)acrylic acid and (meth)acrylate ester, styrene/maleic anhydride

copolymer, and the reaction product of styrene/maleic anhydride copolymer and alcohols. These may be used on their own or two or more may be jointly used. Amongst such materials, those which have excellent pigment dispersion properties, excellent compatibility with the polyfunctional monomer and photopolymerization initiator, together with suitable alkali developer solubility, organic solvent solubility, strength and softening point are preferred. Specifically, a copolymer of (meth)acrylic acid and (meth)acrylate ester is preferred.

[0105] The weight average molecular weight of this binder polymer with acidic groups is preferably 5,000 to 200,000. If the weight average molecular weight is less than 5,000, then there are problems in terms of the formation of a coated film, while if it is more than 200,000 then the viscosity of the coloured photosensitive composition may be increased.

[0106] The content of the aforesaid binder polymer with acidic groups in the aforesaid coloured photosensitive composition is about 20-80 wt% in terms of total solids content. If the amount is less than 20 wt%, problems may arise in terms of the formation of the coated film, while with more than 80 wt% it will be difficult for the performance of the other materials present to be manifested.

[0107] - Polyfunctional Monomer with at least Two Ethylenically-Unsaturated Double Bonds -

Known examples of said polyfunctional monomer with two or more ethylenically-unsaturated double bonds are the known (meth)acrylate esters, urethane (meth)acrylates,

(meth)acrylamides, allyl compounds and vinyl esters described in JP-A-60-258539. One of these may be used, or there may be jointly employed two or more thereof. Amongst the examples given, the (meth)acrylate esters are preferred.

[0108] The content of this polyfunctional monomer with ethylenically-unsaturated double bonds in the aforesaid coloured photosensitive composition is preferably 10-60 wt% of the total solids content. If the amount is less than 10 wt%, then the curing ability at the time of exposure is inadequate, while if it exceeds 60 wt% then it will be difficult for the performance of the other materials present to be manifested.

[0109] - Photopolymerization Initiator -

As the aforesaid photopolymerization initiator, there is preferably used at least one compound having a molecular absorptivity (extinction) coefficient of at least about 50 in the wavelength range 300-500 nm, and examples of such compounds are the aromatic ketones, lophine dimer, benzoin, benzoin ethers, and polyhalogens, etc, described in JP-A-2-48664, JP-A-1-152449 and JP-A-2-153353. One of these may be used on its own, or two or more may be jointly used. Amongst such examples, the combination of 4,4'-bis(diethylamino)benzophenone and 2-(o-chlorophenyl)-4,5-diphenylimidazole dimer, or 4-[p-N,N-di(ethoxycarbonylmethyl)-2,6-di(trichloromethyl)-s-triazine] are preferred.

[0110] The amount of aforesaid photopolymerization initiator in the coloured photosensitive composition is preferably 0.2 to 10 wt% of the solids content in the

photosensitive composition. If the amount is less than 0.2 wt%, the exposure sensitivity may be lowered, while if it exceeds 10 wt% then the exposure sensitivity can be too great (so control is difficult).

[0111] The coloured photosensitive composition can be prepared for example by mixing together the aforesaid pigment-dispersed composition and the photosensitive composition under suitably-selected conditions and using suitable means.

[0112] The formation of a coloured image using the aforesaid coloured photosensitive composition can be carried out basically by means of the following three stages.

(1) A stage in which the aforesaid pigment-dispersed composition is prepared, after which the aforesaid coloured photosensitive composition is prepared using this.

(2) A stage in which the coloured photosensitive composition obtained is applied onto a substrate and then dried, or it is applied onto a separate temporary support and dried to form a layer and then this transferred to the substrate, so as to produce a layer based on the coloured photosensitive composition.

(3) A stage in which the layer based on the coloured photosensitive composition is exposed to light, then developed and a pattern formed.

[0113] The production of a colour filter for use in a liquid crystal display or the like can be carried out by

the combination of two or more colour patterns, by the repetition of aforesaid stages (2) and (3). The method of production of a colour filter by the transfer method is described in, for example, JP-A-4-208940, JP-A-5-72724, JP-A-5-80503 and JP-A-5-173320, etc.

[0114] As the aforesaid substrate, there is generally used a transparent material such as a glass plate or transparent plastic. In order to enhance the adhesion between the substrate and the aforesaid coloured photosensitive composition, there may be added various types of commercial silane coupling agent or the like to the coloured photosensitive composition, or the substrate may be given a coupling treatment beforehand.

[0115] The application of the coloured photosensitive composition coating liquid onto the aforesaid substrate can be carried out by a known application means such as a spin coater, roll coater, bar coater, curtain coater or the like.

[0116] As a method for transferring the aforesaid layer of coloured photosensitive composition formed on a temporary support to the substrate, there may be suitably employed a heated roller laminator at normal pressure or under reduced pressure.

[0117] Examples of the liquid developer used at the time of the aforesaid development are aqueous solutions of alkali metal or alkaline earth metal hydroxides, carbonates and bicarbonates, or an aqueous ammonia solution or an aqueous solution of a quaternary ammonium salt. One of these may be used on its own or there may be employed two or more in combination. Amongst these

examples, an aqueous sodium carbonate solution is particularly preferred.

[0118]

[Examples] Below, examples of the present invention are explained but the invention is not to be restricted in any way by these examples.

[0119] (Example 1) A red pigment-dispersed composition of the following formulation was prepared.

C.I. Pigment Red 254	8.28 g
pigment dispersant from Synthesis Example 1	8.28 g
1-methoxy-2-propyl acetate	63.44 g

[0120] The aforesaid red pigment composition formulation was subjected to dispersion for 9 hours using a Motor Mill M50 (produced by the Eiger Co.) using zirconia beads of diameter 0.65 mm, at a circumferential velocity of 9 m/s.

[0121] The pigment-dispersed composition obtained was evaluated as described below.

(1) Viscosity measurement: The viscosity of the pigment-dispersed composition obtained was measured using an E-type viscometer and the extent of increase in viscosity evaluated. The results are shown in Table 1.

[0122] (2) Contrast measurement: The pigment-dispersed composition obtained was coated onto a glass substrate so that the thickness was 6  $\mu\text{m}$  and a sample thus prepared. This sample was placed between two polarizers, and then the transmittance measured when the polarizing



axes were parallel and when they were perpendicular. The ratio thereof was taken as the contrast (see the (7<sup>th</sup> Colour-Optics Conference 1990, Colour Filter for a 512 Colour Display 10.4" size TFT-LCD, by Ueki, Koseki, Fukunaga and Yamanaka). The results are shown in Table 1.

[0123] (Example 2) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 2, and then evaluation was performed in the same way as in Example 1.

[0124] (Example 3) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 3, and then evaluation was performed in the same way as in Example 1.

[0125] (Example 4) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 4, and then evaluation was performed in the same way as in Example 1.

[0126] (Example 5) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 5, and then evaluation was performed in the same way as in Example 1.

[0127] (Example 6) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 6, and then evaluation was performed in the same way as in Example 1.

[0128] (Example 7) A yellow pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 was replaced by the pigment dispersant of aforesaid Synthesis Example 7, and C.I. Pigment Red 254 was changed to C.I. Pigment Yellow 13, and then evaluation was performed in the same way as in Example 1.

[0129] (Example 8) A green pigment-dispersed composition was prepared in the same way as in Example 1 except that, instead of the formulation for the red pigment-dispersed composition in Example 1, there was used the following formulation of green pigment-dispersed composition, and then evaluation was performed in the same way as in Example 1.

C.I. Pigment Green 36	9.20 g
C.I. Pigment Yellow 138	4.96 g
pigment dispersant from Synthesis Example 6	14.16 g
1-methoxy-2-propyl acetate	51.68 g

[0130] (Example 9) A blue pigment-dispersed composition was prepared in the same way as in Example 1 except that, instead of the formulation for the red pigment-dispersed composition in Example 1, there was

used the following formulation of blue pigment-dispersed composition, and then evaluation was performed in the same way as in Example 1.

C.I. Pigment Blue 15;6	14.20 parts by weight
pigment dispersant from Synthesis Example 6	14.20 parts by weight
1-methoxy-2-propyl acetate	51.70 parts by weight

[0131] (Comparative Example 1) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 used in Example 1 was replaced by copolymer of dimethylaminoethyl acrylate-methyl methacrylate and 2-hydroxyethyl acrylate (weight ratio: 15/85, <sup>iv</sup> weight average molecular weight 20,000), and then evaluation was performed in the same way as in Example 1.

[0132] (Comparative Example 2) A red pigment-dispersed composition was prepared in the same way as in Example 1, except that the pigment dispersant of aforesaid Synthesis Example 1 in Example 1 was replaced by the following copolymer (polymer solution), and then evaluation was performed in the same way as in Example 1. The copolymer (polymer solution) was obtained in the same way as in Synthesis Example 2 above, except that there was used the following monomer solution in aforesaid Synthesis Example 2.

(Monomer Solution)

2-hydroxyethyl methacrylate	4.5 parts by weight
methacrylic acid	4.5 parts by weight
benzyl methacrylate	18.0 parts by weight

polymethyl methacrylate with a methacryloyl group at one terminal (number average molecular weight 6000, Macromonomer AA-6, produced by the Toagosei Chemical Industry Co.)

3.0 parts by weight

1-methoxy-2-propyl acetate

45 parts by weight

[0133] (Example 10) A coloured photosensitive composition for producing a colour filter was prepared by mixing together the following components.

red pigment-dispersed composition of Example 1

32.4 parts by weight

methacrylic acid/benzyl methacrylate polymer (mol ratio 28 : 72, weight average molecular weight 30,000, 30%-1-methoxy-2-propyl acetate solution)

9.0 parts by weight

4-[p-N,N'-di(ethoxycarbonylmethyl)-

2,6-di(trichloromethyl)-S-triazine 0.2 part by weight

hydroquinone monomethyl ether

0.01 parts by weight

1-methoxy-2-propyl acetate

62.0 parts by weight

[0134] Mixing was carried out for 9 hours using a Motor Mill M50 (produced by the Eiger Co.) employing zirconia beads of diameter 0.65 mm, at a circumferential velocity of 9 m/s.

[0135] The viscosity of the coloured photosensitive composition for producing a colour filter which was obtained was measured in the same way as in Example 1, and then a colour filter was produced in the following manner, after which the contrast was measured in the same way as in Example 1. The results are shown in Table 1.

[0136] Specifically, using a spin coater the aforesaid coloured photosensitive composition for producing a

colour filter was applied onto a glass substrate, and dried for 2 minutes at 100°C to form a film of thickness about 2  $\mu\text{m}$ . Next, under a current of nitrogen, exposure was performed using an ultra-high pressure mercury lamp, after which developing was carried out with 1% aqueous sodium carbonate solution. The contrast of the colour filter obtained was measured in the same way as in Example 1.

[0137] (Example 11) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the red pigment-dispersed composition from Example 2, and then evaluation was performed in the same way as in Example 10.

[0138] (Example 12) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the red pigment-dispersed composition from Example 3, and then evaluation was performed in the same way as in Example 10.

[0139] (Example 13) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the red pigment-dispersed composition from Example 4, and then evaluation was performed in the same way as in Example 10.

[0140] (Example 14) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the red pigment-dispersed composition from Example 5, and then evaluation was performed in the same way as in Example 10.

[0141] (Example 15) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the red pigment-dispersed composition from Example 6, and then evaluation was performed in the same way as in Example 10.

[0142] (Example 16) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the green pigment-dispersed composition from Example 8, and then evaluation was performed in the same way as in Example 10.

[0143] (Example 17) A coloured photosensitive composition was prepared in the same way as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the blue pigment-dispersed composition from Example 9, and then evaluation was performed in the same way as in Example 10.

[0144] (Comparative Example 3) A coloured photosensitive composition was prepared in the same way

as in Example 10 except that the red coloured pigment-dispersed composition from Example 1 used in Example 10 was replaced by the blue pigment-dispersed composition from Comparative Example 1, and then evaluation was performed in the same way as in Example 10.

[0145]           (Comparative Example 4)           A coloured photosensitive composition was prepared in the same way as in Example 10 except that the pigment dispersant from aforesaid Synthesis Example 1 was replaced by the following copolymer (polymer solution), and then evaluation was performed in the same way as in Example 10. The copolymer (polymer solution) was obtained in the same way as in aforesaid Synthesis Example 1, except that the following monomer solution was used.

(Monomer solution)

3-(N,N-dimethylamino)propylacrylamide

4.5 parts by weight

polymethyl methacrylate with a methacryloyl group at one terminal (number average molecular weight 6000, Macromonomer AA-6, produced by the Toagosei Chemical Industry Co.)

25.5 parts by weight

1-methoxy-2-propyl acetate

45 parts by weight

[0146]   (Test) At the time of the preparation of a photosensitive material using the pigment dispersant from Example 1, a comparison was made between the case (referred to below as "prior addition") where, prior to the dispersing and mixing of the acidic binder and other components, just the pigment was dispersed using the dispersant after which the mixing and dispersing of the acidic binder and other components was carried out to produce the liquid for the photosensitive material, and the case (referred to below as "post addition") where

the liquid for the photosensitive material was produced by mixing and dispersing using the pigment dispersant at the same time as the acidic binder and other components. As a result, in the case of prior addition, the nitrogen atoms in the aforesaid graft copolymer were adsorbed at the surface of the pigment so thereafter, even when the aforesaid acidic binder, etc, was added, no increase in the viscosity of the liquid for the photosensitive material was noted. In contrast, in the post addition case, the nitrogen atoms in the graft copolymer interacted with the acidic binder added at the same time as the pigment dispersant, so the pigment dispersivity was inadequate, a rise in the viscosity of the liquid for the photosensitive material was noted and it was not possible to produce the photosensitive material.

[0147]



[Table 1]

	Viscosity (cp)	Contrast		Minimum Developing Time (sec)
		Film from Pigment-Dispersed Liquid	Film of Photosensitive Composition	
Example 1	20	1250	-	-
Example 2	20	1300	-	-
Example 3	25	1250	-	-
Example 4	20	1300	-	-
Example 5	25	1350	-	-
Example 6	15	1300	-	-
Example 7	20	1100	-	-
Example 8	60	1500	-	-
Example 9	65	1400	-	-
Example 10	-	-	1100	15
Example 11	-	-	1150	15
Example 12	-	-	1100	15
Example 13	-	-	1150	20
Example 14	-	-	1250	20
Example 15	-	-	1150	25
Example 16	-	-	1400	20
Example 17	-	-	1300	20
Comp.Ex.1	200	1000	-	-
Comp.Ex.2	high viscosity*	-	-	-
Comp.Ex.3	200	-	900	30
Comp.Ex.4	20	-	1300	>50

\*During the dispersion, the viscosity became very high and dispersion was impossible.

[0148] From the results in Table 1, it is clear that the pigment-dispersed compositions of the present invention which contained a pigment dispersant according to the present invention, and the coloured photosensitive compositions employing same, had a low viscosity and produced high contrast. The fact that a high contrast was obtained is thought to be because the pigment particles were dispersed in a finely-divided state. On the other hand, it is clear that in the case of the pigment-dispersed compositions from the comparative examples and the coloured photosensitive

compositions employing same, the viscosity was high and the contrast low. Furthermore, in the case of the coloured photosensitive composition in Comparative Example 4, which employed a graft copolymer which did not contain copolymer units based on a polymerizable monomer with an ether group, it was not possible to obtain adequate developing properties using an aqueous alkali solution.

[0149]

[Effects of the Invention] In accordance with the present invention, it is possible to resolve the various aforescribed problems of the prior-art. Moreover, in accordance with the present invention it is possible to provide a pigment dispersant which gives pigment stability without aggregation of the pigment, together with excellent dispersion and flow properties, and which is also excellent in terms of suitability for alkali development. Again, in accordance with the present invention, it is possible to provide a pigment-dispersed composition containing said pigment dispersant which is outstanding in terms of its pigment dispersion and flow properties, has a high colouring power, excellent light transmission and can be favourably employed in wide-ranging applications such as coating materials, printing inks and colour display panels. Furthermore, in accordance with the present invention, it is possible to provide a coloured photosensitive composition containing said pigment-dispersed composition which has high colouring power, is excellent in its alkali development suitability, and can be favourably used for forming colour proofs or other such multi-coloured images on a

substrate, or for producing colour filters used in liquid crystal displays, etc.

[Brief Explanation of the Drawings]

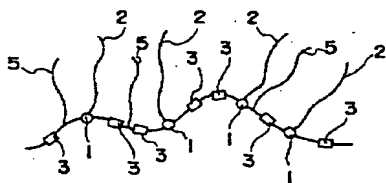
[Figure 1] This is a schematic explanatory diagram showing the pigment dispersant of the present invention.

[Figure 2] This is a schematic explanatory diagram showing the state when the pigment dispersant is adsorbed onto the surface of a pigment particle.

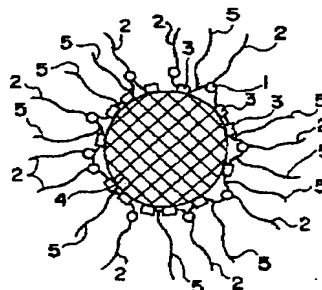
[Explanation of the Numerical Codes]

- 1 connection between main chain and side chain
- 2 side chain
- 3 nitrogen atom
- 4 pigment particle
- 5 side chain with ether groups

[Figure 1]



[Figure 2]



### *Translator's comments*

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<sup>i</sup> Perhaps 'styrene' was intended here rather than 'polystyrene'.

<sup>ii</sup> The words in italics do not appear in the original but would seem to be intended.

<sup>iii</sup> Explanation of 'S' has been omitted in the original Japanese text but clearly it is not sulphur.

<sup>iv</sup> This copolymer seems to have three components, so it is not clear what 15/85 means.